Summary of Communications Systems

Subway Radio System

NYCT's subway radio system is an older system which is anticipated to be replaced with a new rapid transit operations and command center around the turn of the century. It currently is a "voice only" system and operates in the VHF band with separate frequencies for the IRT, BMT and IND divisions. The Command Center relies on the oral communications from crew members to ascertain the status of incidents, the location of trains, and similar information. As noted in the Safety Board of Inquiry concerning the Clark Street Fire:

> "One of the difficulties faced by Command Center personnel is physically locating trains on the system. The technology being used is dated (circa 1950) and does not provide train occupancy (where trains are located) for 90% of the system. Command Center personnel must rely on towers and direct radio communications to establish train locations. This can be a difficult, time consuming task, that if not quickly accomplished, can have adverse effects on rescue efforts.
>
> "It appears to the Board that an effort to modernize Command Center facilities is required if these kinds of difficulties are to be overcome."

The radio system is largely an inflexible one, with no ability to isolate particular geographical areas in the event of an emergency. It is necessary for a "clear the air" command to be given in many emergency situations, making it impossible for less significant problems to be handled simultaneously by Command Center personnel.

While it is anticipated that some of these deficiencies can be addressed with a major capital investment for a new command center, in order to alleviate the inefficiencies of the existing radio system, additional frequencies will be required to enable the transmission of voice and data and to provide interoperability with emergency first responders.

Bus Radio System

Modernized in the late 1980s at a cost of about $50 million, the bus communications sytem enables a large number of users in all five boroughs to be served by sharing channels in the 800 MHz trunked system. "Talk groups" can be set up and reorganized as needed to address situations. A silent alarm feature can summon help if there is an on-board crime or other emergency. Prior to its implementation, the bus system was dependent upon an antiquated two-way radio system, the problems of which are too many to detail. Parts could not even be found to keep the 30-year old equipment in working order. NYCT struggled to equip its "nighthawk" buses (those operating after midnight) with a working radio to protect the safety of its passengers and bus operators from criminal assaults.

Police Radio System

The inadequacies and limitations of the TAPD radio system during the early 1980s were well-known within both NYCT and the City of New York. Several short-term upgrades were made in the late 1980s and early 1990s to improve the system before a new communications system could be put in place. Funds were committed to improve the cable installed along the right-of-way carrying the voice communications of the TAPD officers. Efforts were undertaken to eliminate dead spots in the system, and other interim solutions were implemented. A significant improvement in the communications functioning of TAPD was the development of a computer aided dispatch system which not only gave the real time status of the TAPD units, but also incorporated the relevant geography of the subway system, including locations of emergency exits. NYCT is in the process of redesigning a major communications

improvement for police personnel on its system. Because TAPD merged into NYPD in April 1995, the original design concept has been revised to reflect NYPD's special needs. As currently envisioned, the above-ground police will not lose their ability to communicate in the below-ground environment of the subway system, and provision for interoperability will be made. NYCT has committed to invest in excess of $100 million to the communications system because it believes that such an improvement will ultimately prove to be for the long-term safety of our customers.

EXHIBIT B

Excerpts From
NYCT Board of Inquiry
Concerning
Clark Street Fire
Which Occurred on
December 28, 1990

NEW YORK CITY TRANSIT AUTHORITY

Board of Inquiry
Clark Street Incident
Final Report

March 7, 1991

EXECUTIVE SUMMARY

At approximately 9:05 A.M. on December 28, 1990, a Manhattan-bound #3 train (the 8:34 A.M. from New Lots Avenue to 148 Street-Lenox) contacted Bowling Green Tower and reported a smoke condition approximately 30 feet south of the Clark Street Station on track #3. Once reported to the tower, the Train Operator was able to depart Clark Street Station and continue on to his final destination. This was the first indication of an incident that would rapidly escalate to a situation requiring a coordinated rescue effort involving the New York City Transit Authority, the New York City Transit Police, the New York City Police Department, the New York City Fire Department, and the New York City Emergency Medical Service.

Approximately three minutes later, a Brooklyn-bound #2 train (the 7:34 A.M. #2 from 238 Street) arrived at the Clark Street Station on track #2. The Train Operator made a normal station stop to discharge passengers, heard an explosion and observed smoke ahead of his train. The Train Operator attempted to report this condition to the NYCTA Rapid Transit Operations Division Command Center by radio, however, this attempt was unsuccessful. The Train Operator's communication was heard by the Tower Operator of the Nevins Street Tower who telephoned the Command Center to alert them that the 7:34 A.M. #2 train was trying to reach them. At this point, approximately 5 minutes after the incident was first recognized, the Command Center communicated with the Train Operator of this #2 train. The Command Center was informed that a heavy smoke condition existed and that the Train Operator was discharging all passengers and securing the train.

It must be noted that the weather conditions that existed at the time of this incident were extremely hazardous. During the evening of December 27-28, 1990, a storm had dropped 6.6 inches of snow on the City which contributed to traffic congestion in downtown Brooklyn and the ability of emergency units to respond to the situation as rapidly as they otherwise could have.

At 9:11 A.M. the Command Center contacted the Chambers and Nevins Street Towers and instructed them to prevent additional trains from entering the incident area. At 9:12 A.M. the Command Center reported over the "6-wire" (a NYCTA interdepartmental intercom system) that a fire and subsequent explosions were reported between Clark Street and Borough Hall Stations. Additionally, during this time frame the NYC Transit Police were dispatching two of their Emergency Medical Rescue Units (EMRU) to the scene. At 9:13 A.M. Command Center informed the New York City Fire Department of the situation and within six (6) minutes units began arriving at the scene (Clark St.).

Within the same period of time a Manhattan-bound #3 train (the 8:42 A.M. train from New Lots Avenue to 148th Street-Lenox) also reported an explosion and smoke from what appeared to be an electrical fire to the Command Center. The Train Operator indicated that the fire was in front of his train just south of the Clark Street Station. He also indicated that he was going to hold his train in the tube, approximately 150 feet south of the fire location.

After becoming aware of the situation at the Clark Street Station, the Authority's Command Center activated its internal emergency notification procedures for New York City Transit Authority Divisions and Departments, and external notification procedures for New York City response agencies. Initial notification to all agencies, except for Emergency Medical Services was completed at 9:12 A.M. At 9:14 A.M., the Transit Police contacted a 911 operator and requested that the New York City Police Department and Emergency Medical Service respond to the incident. At 9:15 A.M., the 911 operator contacted the Emergency Medical Service and requested that units be dispatched. An Emergency Medical Service Basic Life Support Unit reported to Clark Street at 9:28 A.M.

Subsequent to the emergency notification process, the Command Center became deeply involved in locating trains in the vicinity of the Clark Street Station in order to develop plans for their removal from the situation. Essentially five trains were involved: a Brooklyn-bound train that had discharged its passengers and was standing in the station; two other Brooklyn-bound trains that were in the underriver tube between Manhattan and Brooklyn; a Manhattan-bound train standing in Borough Hall; and the Manhattan-bound 8:42 A.M. #3 New Lots train that was standing 150 feet south of the Clark Street Station that, in retrospect, was the only train in immediate danger during the course of the incident. While the Command Center was involved in the process of locating the respective trains, the situation with respect to the 8:42 A.M. #3 New Lots train continued to deteriorate. The Train Operator concluded that, in view of the ongoing explosions and the smoke that was beginning to infiltrate into the cars, he should move his passengers to the rear of the train.

By 9:24 A.M., the Command Center had decided to move the 8:42 A.M. #3 New Lots train back to Borough Hall Station. The ability to do so was contingent upon the Train Operator moving to the south end of his train and for the train standing in Borough Hall to be moved out of the station so that the 8:42 A.M. could enter the station

The train was ready to move at 9:37 A.M. but could not be moved because someone had activated the emergency brake valves in two cars. By 9:41 A.M. this condition had been corrected and the train began its move back to Borough Hall at 9:42 A.M. Three minutes later, at 9:45 A.M. the train entered Borough Hall Station and stopped with five cars in the station.

As a result of this incident 200 people claimed to have been injured due to smoke inhalation. 128 passengers were removed to local hospitals using NYCTA buses where they were treated and released. One passenger died on the train. Another passenger was removed to a local hospital where she subsequently died.

On December 31, 1990, Executive Vice President, New York City Transit Authority, directed that a Board of Inquiry be convened to investigate the circumstances surrounding the incident and to prepare recommendations whose implementation should reduce the likelihood for the recurrence of a similar incident.

The Board determined that the primary cause of the incident was the failure to replace concrete removed from the tunnel wall during the installation of third rail transposition cables. Contributing to the incident was the introduction of wet snow into a normally dry, steel dust contaminated environment that permitted the development of an electrical path to an exposed section of the metal tunnel liner.

The primary cause of passenger injuries was the duration of exposure to the dense smoke that was generated as a combustion by-product of the electrical cable insulation and conduit.

The Board also reached numerous conclusions with respect to: the effect that fan operations may have had on the smoke; the effect the snow had on the incident; the method selected to extricate the passengers from the incident scene; the performance of the train's crew and the Command Center; and, finally, the effectiveness of the liaison between the New York City Transit Authority, and the Transit Police Department, New York City Police Department, New York City Fire Department and Emergency Medical Service.

- o Fan Operations: The fans for the underriver tubes were designed to provide a flow of fresh air into the faces of passengers being evacuated on the roadbed, from trains that had become disabled in the tube or to blow smoke away from the passengers. The smoke being generated in the incident was not within the tube. The Furman Street fans had not been operational since 1984 and the Johnson Street fan operates in the exhaust mode only. Since the Johnson Street fan was behind the 8:42 A.M. #3 New Lots train, its operation would have drawn smoke past the train toward Borough Hall, an undesirable action. With respect to fan operation, the Board concluded that the location of the fans in relation to the station and the trains in the vicinity would have rendered their utility questionable. The Board concluded, with the information available to it, that not turning on the fans at Johnson Street until after the passengers were discharged was a correct decision.

- o Effect of Snow: Snow had fallen overnight and was carried into the subway system on the roofs of trains that had been stored out-of-doors. It was then dislodged by cross drafts at the incident site and deposited on the roadbed approximately 30 feet south of Clark Street Station, thereby changing a historically "dry" location to one that was covered by heavy, wet snow and water. This wet condition was made worse by an inoperative track drainage system.

- o Method to Extricate Passengers: The Command Center had several options with respect to removing passengers from the smoke filled environment. Among those were to evacuate the passengers on foot either to the roadbed or to the benchwalk; to move the train through the arcing condition into the Clark Street Station; to move the train back to Borough Hall; or, to use a reach train. The thought of evacuating a thousand passengers to the roadbed or a benchwalk in

dense, choking smoke, without considerable assistance and under poor lighting conditions is a daunting one at best. It is also an uphill climb from Clark Street to Borough Hall. The track has an invert that poses a considerable tripping hazard. Trying to walk on a narrow benchwalk would have also been difficult. The potential for more casualties due to overexertion cannot be over-looked. Although the train could have potentially been moved through the fire and into the Clark Street Station, this would not have been a prudent decision, as it would have exposed the passengers to the smoke/fire/explosions at close range. There was also a risk that the train might has stalled immediately adjacent to the fire site.

The decision to move the 8:42 A.M. #3 New Lots train back to Borough Hall was the correct decision with respect to passenger safety.

- o **Performance of Command Center**: The performance of the Command Center played a key role in this incident. Inasmuch as the Command Center is responsible for notifying all personnel within the Authority, and those from outside agencies as well, regarding the occurrence of such incidents and coordinating all related internal emergency response activities, they have a greater effect on the successful handling of an incident than any other internal or external function.

  With respect to initial notifications the Command Center performed adequately in that it notified internal Authority divisions and police and fire agencies in a timely manner. However, the lack of a timely notification to Emergency Medical Services, as well as to status report updates regarding the location of the stranded train and the environmental conditions they were in significantly impaired a timely and effective response on the part of Emergency Services personnel to treat passenger casualties at the Borough Hall Station.

  However, it is clear that the Command Center's focus of attention during this incident was on the trains stranded in the underwater tube rather than on the one located closest to the fire. The lack of timely follow-up communication with the train closest to the fire resulted in the Command Center not fully understanding the seriousness of the situation on that train. As a result, although they were expeditiously taking action to bring the trains in the Clark Street tube back into the Wall Street Station, this activity did not place a high-enough emphasis on moving the train that was in the most danger. This resulted in some delay, in minutes, in having the train brought back into the station at Borough Hall where emergency evacuation and rescue efforts could begin. This had a critical effect on the overall incident.

- o **Delay in the Wrong Rail Move:** At 9:15 A.M. the Train Operator of the 8:42 A.M. #3 NLT was granted permission by the Command Center to move his passengers to the rear of the train. It was not until 9:42 A.M., however, that the Train Operator was ready and able to move the train back to Borough Hall. While the decision to move the train back to Borough Hall was correct, the delay in affecting the move was the problem. Factors interfering with the ability of the Train Operator to accomplish this sooner included: 1) difficulties walking 450 feet (nine cars) through the crowded train at the same time that passengers were moving through the train (concentrating in cars toward the rear of the train); 2) emergency brake valves that had been activated and had to be reset; 3) the collapse of a passenger in the third car; and 4) possible delays communicating with the Command Center because of an incorrect switch setting.

This final report of the Board of Inquiry presents the findings developed during the Board's investigation; a discussion and analysis of all factors related to the incident; and interviews with various personnel involved in the incident. Also included are the Board's conclusions as to what caused or contributed to the fire and related injuries; and the Board's recommendations with respect to actions that should be taken to reduce the likelihood of the recurrence of a similar incident.

2. Mechanical Effect of the Snow
As previously stated, the Clark Street Station had been regarded as a "dry location". The addition of the snow, which came from the tops of passing subway cars that had been stored out of doors, created an unusual wet condition. The snow that fell from the passing subway cars was wet and heavy.

3. Possibility of Cable Rubbing Against the Tube Liner
The transposition cables at this location have been there since approximately 1971. Due to lack of space between the third rail and the tunnel's benchwall, concrete was removed to accommodate the cable's installation. When the concrete was removed, a section of the metal tunnel liner was exposed. Upon completion of the installation in the early seventies, the transposition cables may have been very close to the tunnel liner. As part of Track and Structures' maintenance program, these cables were inspected twice a year and there were no reports of worn insulation of these cables.

4. Damming of Melted Snow
Due to the fact that the Clark Street Station is considered to be a normally dry location, the drains are not routinely checked or inspected. They are cleaned when they are reported to be blocked and water is standing on the track's invert. Without periodic inspection, the only way to verify that a drain is not functioning is for water to be backed-up and a report generated. Given the depth and weight of the snow and the lack of drainage in the area, it would have been possible for the water level to have risen to a point where contact with the third rail was made. When contaminated by steel dust and dirt, the snow and water could have served as a weak electrolyte, thereby creating a leakage path to the exposed tube liner.

5. Third Rail Lighting Taps
It is common practice to install third rail taps to bring third rail power into a station or for use at work locations on the roadbed. These taps are generally made up of #6 gauge wire. At Clark Street, in the immediate vicinity of the transposition cables, a third rail tap had been installed. The tap at Clark Street was reported to have been in a state of good repair.

The tap was attached to the gauge side of the third rail with a #6 gauge wire that passed under the third rail and up to the fuse box. A second cable was strung from the fuse box to the location where the power is needed.

E. EMERGENCY COMMUNICATIONS

1. Intra-agency
T/Os experienced difficulty contacting the Command Center initially. Tower operators had difficulty contacting the Command Center over the radio until telephone contact had been established. Thereafter, radio communications improved. Six (6) wire communications with Stations, Transit Police and Track and Structures were normal. The Transit

Police monitored the 6-wire as well as normal communications with their Emergency Medical Response Units and responding Police Officers. The Track and Structures, Electrical, and Stations Division monitored and responded to the 6-wire announcement of the smoke/fire condition at Clark Street.

2. Inter-agency
The Brooklyn Fire Dispatcher (#304) was notified to have units respond to Clark Street at 9:13 A.M. The Transit Police Communications Unit contacted 911 at 9:14 A.M. (Operator #779) and requested that the New York City Police Department and EMS respond. At 9:15 A.M., the NYPD contacted the EMS and requested that EMS respond to the scene (EMS Operator #967).

3. Communication Discipline
Throughout the incident, the 12-1 (clear the air) code was called for by train operators and the C/C. A review of the RTO transcripts revealed that train operators and supervision failed to adhere to the code's meaning.

4. Train Radios
Until recently, the only method of communication available between the train and the Command Center or Towers was the T/O's (20-watt) radio. This radio is capable of operation only when placed in its bracket in the T/O cab. In 1990, all Conductors (C/R) were given hand-held, (6-watt) portable radios that have the capability of transmitting and receiving to the C/C, Towers and/or to other trains. These units are battery-powered and do not have to be installed in brackets. The C/R's radio has a two-position toggle switch that is used to select train-to-train (T) or train-to-Command Center (C) frequencies.

The "C" position on the C/R's radio enables the C/R to transmit to the Command Center on frequency 161.190 MHz and receive on frequency 158.880 MHz (train-to-train). The "T" position enables the C/R to transmit and receive on frequency 158.880 MHz thus not allowing transmission between trains to be heard by the C/C.

The C/R can hear Command Center transmissions regardless of the toggle switch's position.

F. FANS

1. Fan Status
There are three (3) fan plants located in the vicinity of the Clark Street Station and the underriver tubes. These are the Old Slip Fan Plant (#7229), located 1,100 feet south of Wall Street (Manhattan); the Johnson Street Fan Plant (#7231), which is located 450 feet north of Borough Hall (Brooklyn) at Station #284+00; and the Furman Street Fan Plant (#7230) located 860 feet north of Clark Street (Brooklyn) at Station #260+40. At the time of the Clark Street incident, the Old Slip fan plant (2 fans) and the Johnson Street fan plant (1 fan) were in service. The Furman Street fan plant (4 fans) was under construction. The Furman Street fan plant has been out-of-service since August 30, 1984. It is anticipated that it will be returned to service by March 31, 1992 (see Appendix D).

D. Emergency Response

The response to the incident depended, in the main, on the simultaneous accomplishment of several activities, among these being:

- The determination of the extent and severity of the problem at hand, and;

- The timely notification and direction of in-house team and external response agencies.

1. Communication Systems

The Authority has a wide array of communication capabilities. These have been detailed in the Clark Street Interdepartmental Task Force Report to the President, NYCTA, published on February 11, 1991. For the purpose of this report the Board narrowed its focus to the means of communication immediately available to the Console Train Dispatcher (C/T/D) and the Desk Superintendent (DS), the individuals in the Command Center who were directly involved in managing this incident. Communication equipment available consisted of the following systems:

a. The "6" Wire: This is an inter/intra departmental intercom that is a "talk/listen" system between the C/C, the Rapid Transit Operations Divisions (Stations, Rapid Transit, Car Equipment, Electrical Systems), the Transit Police, and other offices throughout the Authority. This system enables all parties on the line to hear all transmissions at the same time. This system was operational during the Clark Street incident.

b. Ring Down Lines to Emergency Medical Services (EMS): Ring down lines are telephone lines that are activated when a telephone receiver on an instrument is picked up. When the receiver is picked up, all parties can talk on the line. It is not necessary to dial a number although there may be a "push to talk" feature on the hand instrument being used depending on the age/type of equipment available.

Two ring down lines had been installed. One line was installed prior to 1990. It connected the Transit Police (TAPD), the Rapid Transit Operations (RTO) Command Center and the Emergency Medical Service (EMS) Tour Commander's desk at the EMS' Maspeth, Queens facility. This line was functional during the Clark Street incident.

A second ring down line, connecting the Transit Police Communications Unit with the EMS Specialty Desk had been installed in 1990. This line was not functional during the Clark Street incident. An investigation of the problem after the incident revealed that the line to the EMS had not been connected on any equipment" at the EMS end.

The Board's review of the difficulties experienced in communicating with EMS on the morning of the incident, revealed that one (1) of the ring down lines was out of service because it had never been properly terminated within the EMS facility. The second ring down line went directly to the EMS Tour Commander's desk. Were this person not at his/her duty station, the phone would have gone unanswered, which appears to have been the case, initially.

NOTE: It should be pointed out that the Authority is only responsible for the communication hook ups to the EMS facility but not within the facility itself because of the interface between the vendors who install and maintain the respective entities' telecommunications equipment. Due to the seriousness of this issue, the Authority working with the New York Telephone Company corrected this deficiency on January 11, 1991.

c. Centrex Lines: Centrex Lines are essentially "330" numbers used by the Authority on its own switching system. During 1990 the Authority installed three (3) of these lines at the EMS' Maspeth facility (copies of all work orders are included in the Appendix). One (1) of these lines (330-4862) was to have been hooked to an automatic call distribution system (ACD) as a back up for two (2) other lines (330-4492 and 4861) which were to be used to connect the Transit Police with the EMS Call Receiving Operator Dispatcher's position. This line was out of service at the time of the Clark Street incident.

A characteristic of the Centrex lines is that the dialer will hear the telephone ring from a signal generated by the Telephone company whether or not an instrument has been installed on the receiving end. This is a situation that could cause the caller to assume that the line was working and no one is there to answer, rather than being non-functional, if the line is not used frequently. This line was restored to service by an EMS equipment vendor on January 14, 1991.

Of the three (3) Centrex lines, one (1) was out of service at the EMS end. The remaining two lines were operable, but not answered. During the course of the Board's investigation the EMS was offered an opportunity to clarify the communications difficulties noted above from its point of view; however, the EMS declined.

The Board learned that no formal procedure existed for periodic checks of the emergency telephone lines. In order to ensure the availability of the means of communications that are presently available to Command Center personnel, it is necessary that communication checks be performed periodically. The results of these checks must be made known to everyone who may have a need to use the emergency lines. Discrepancies must be documented and reported to the Telecommunications group for correction.

Most noticeable was the fact that the Command Center asked few, if any, questions with respect to the location of smoke, its density, direction of movement, and any effects it might have been having on the crew and/or the passengers on the 8:42 A.M. #3 NLT although these questions were asked of the two trains that were in the Clark Street Tube.

As a result, the Command Center did not realize the seriousness of the situation with respect to the 8:42 A.M. #3 NLT until the Train Operator reported an emergency at 9:37 A.M. The failure to develop the situation with respect to the 8:42 A.M. #3 NLT had a significant impact on the subsequent rescue effort.

One of the difficulties faced by Command Center personnel is physically locating trains on the system. The technology being used is dated (circa 1950) and does not provide train occupancy (where trains are located) for 90% of the system. Command Center personnel must rely on towers and direct radio communications to establish train locations. This can be a difficult, time consuming task, that if not quickly accomplished, can have adverse effects on rescue efforts.

It appears to the Board that an effort to modernize Command Center facilities is required if these kinds of difficulties are to be overcome.

In the interim, it might be beneficial to prepare checklists for use by Command Center personnel, to ensure that they acquire the kinds of information they need to be responsive to the situation.

4. Distribution of Work

When the Desk Superintendent took over the responsibility from the C/D/T for managing the emergency, he assigned the C/T/D the duty of recording all activities that occurred during the course of the emergency. The Board reviewed the C/D/T's log and found that the log was not maintained in accordance with Command Center Directive 26-90 (Appendix D) dated January 24, 1990 which requires that "all communications received by the C/T/D should be recorded except where recorded on other prescribed forms." The C/T/D's failure to properly log all calls received may have contributed to his apparent inability to properly locate the 8:42 A.M. #3 NLT throughout the course of the incident. Between 9:13 A.M. and 9:22 A.M., the C/T/D repeatedly placed the 8:42 A.M. #3 NLT north of the Clark Street Station which would have placed the train in the Clark Street Tube, north of the fire.

From 9:11 A.M., when the T/O of the 8:42 A.M. #3 NLT first called the Command Center until 9:23 A.M., the C/T/D experienced problems properly locating the train. A first effort to locate the train started at 9:11 A.M.:

8:42 A.M. #3 NLT

"...I'm on the ah north, the south end of the station."

"...I'm up wind from the situation holding in the tube north of Clark Street, north of Borough Hall."

9:14 C/T/D
"And you're north of Clark Street, right."

8:42 A.M. #3 NLT
"I'm at north Borough Hall, I'm south of Clark Street. The situation is right at the tip of the station."

C/T/D
"Do you have any cars in Borough Hall?"

8:42 A.M. #3 NLT
"No that's - Command Center this thing is exploding, I want to request to move my passengers back to my south of the situation."

C/T/D
"Yeah, OK, listen, take your radio there with you sir."

8:42 A.M. #3 NLT
"Okay."

C/T/D
"Tell me do you have any cars near Clark Street in the station?"

8:42 A.M. #3 NLT
"C/C, I have a, my car is (inaudible) the situation and it's beginning to explode. I'm going to move my passengers to the south end of my train. I'm in the north end. I'm south of Clark Street ... I'm three cars south of the situation."

C/T/D
"Ok you're three cars south of the situation. Move your passengers back to the rear of the train."

At 9:21, a second effort to locate the train was made by the Desk Superintendent and the Console Train Dispatcher:

9:21 Desk Supt.
"42 New Lots what is your exact location?"

Desk Supt.
"42 New Lots are you just north of Clark Street?"

9:22 C/T/D
"8:42 out of New Lots come in for Command."

8:42 A.M. #3 NLT
"Command come in for the 842 New Lots."

C/T/D
"Come in 842 New Lots where are you now?"

8:42 A.M. #3 NLT
"We're just north of Clark Street."

C/T/D
"North of Clark Street on the express track, there, right do you have any trains in front of you there?"

C/T/D
"842 out of New Lots there, you on the south end of your train at Clark Street, north of Clark right?"

8:42 A.M. #3 NLT
"Affirmative."

9:23 C/T/D
"Are you in the tube, you're between Clark Street and Borough Hall, that correct?"

8:42 A.M. #3 NLT
"I'm between Borough Hall and Clark Street."

Desk Supt.
"Alright, very good that is south of Clark, very good."

It was not until the Desk Superintendent took over the management of the emergency that the trains in the incident area were properly located. The location of all trains in an incident area is critical to the emergency response effort with respect to notification and direction of emergency response agencies, preparation of trains for wrong rail moves, planning for fan operations and power removal operations.

In this incident, most of the work load appeared to have been handled by one person which resulted in insufficient information being provided to other emergency response agencies.

5. Fixation on Trains in Tubes

During this investigation it became readily apparent that the Command Center devoted the bulk of its attention to the two Brooklyn-bound trains in the Clark Street Tube.

A review of the Command Center training programs, Command Center directives, and the Authority's Operating Rules reveals that considerable emphasis is placed on resolving emergencies involving fire/smoke conditions in the underriver tubes or trains that have been disabled or, otherwise unable to move. The fact that the Furman Street Fan plants were out of service weighed heavily on the amount of time devoted to moving the two trains out of the underriver tubes. The reason for the emphasis on the underriver tubes is that there are no emergency exits available for passenger evacuation.

The distraction caused by the train in the tubes adversely affected the amount of attention that otherwise would have been afforded the 8:42 A.M. #3 NLT.

Even though the handling of trains in the underriver tubes is extremely important, it is also important to gain an appreciation of the total situation to ensure that emergency response efforts are properly directed.

6. Communications Discipline

From the outset of this, emergency communications discipline was neither established nor maintained. Between 9:10 A.M. and 9:13 A.M. the C/T/D called, "attention, attention all train conductors, please" and, " Utica Tower could you hold off...at this moment, please?", when a 12-1, requesting radio silence should have been issued. Similarly, a train operator and a Desk Superintendent called for 12-1s at 9:11 A.M. (8:42 A.M. #3 NLT) and 9:17 A.M., respectively. None of these efforts had any long term effect and the ensuing mix of calls to and from the Command Center resulted in missed communications and calls to repeat transmissions which severely hampered the C/C's ability to locate trains and move them from the affected area.

After the DS assumed all communications responsibilities, the "6" Wire was not being used effectively to provide situation updates to TA Divisions on the Clark Street situation, particularly between 9:13 A.M. and 9:25 A.M., when little or no update information was provided to in-house forces except in response to scattered requests for information from the Transit Police. The Board found gaps in responses by the Command Center to the queries from various responding departments of the Authority.

7. Train Operators/Conductors Responsibilities

As previously discussed, the C/R is responsible for the safety of the passengers and the train. The Train Operator is responsible for train movement and its safe operation. During the course of its review of the circumstances surrounding the incident, it was apparent that the C/R's contribution to the safety of the passengers was minimal. One of the primary crew activities during train emergencies is panic control.

In reviewing statements of passengers who were on the 8:42 A.M. #3 NLT, the Board found that the most frequent response to the question of seeing uniformed persons or the Train Operator or C/R on the train was "NO". To have effective panic control, it is necessary that the crew (at least the C/R) to move among the passengers and provide them with most recent information or what actions are being taken to resolve the problem.

The lack of crew coordination was evident when the passengers were being moved from the front of the train. As passengers from the first cars moved to the south, they began to bunch up and eventually could move no further. Had the Train Operator informed the C/R of the move, the C/R, in turn, could have moved passengers from his position to the south end of the train. This would have helped the move and reduced the potential for panic on the train.

I. SUMMARY

. Significant Issues

Based upon the review of available information and witness testimony, the following scenerio for this incident was as follows:

The exposed metal tunnel liner, combined with unusual dumping of wet snow mixed with steel dust, provided a leakage current path to initiate the arcing, overheating and burning of the cable insulation. This situation could have been prevented if tube shell protection had been in place. This protection had been planned for several years but was delayed, along with the modernization of the Pierrepont-Furman Street substation, due to community opposition.

The clogged track drainage system in the Clark Street Station hindered the free flow of contaminated water which helped to sustain the arcing and subsequent explosions. The arcing caused the insulation on the transposition cables and conduit to burn which generated a large volume of smoke.

Initial attempts by the T/O's to report the arcing and smoke condition to the Command Center were not answered. It required telephone calls from the Bowling Green and Nevins Street Towers to establish radio communications between the Command Center and the trains in the vicinity of the incident.

The T/O of 8:42 A.M. #3 NLT failed to communicate the spread of smoke toward his train and to adequately stress the impact of the smoke condition on his train. By the same token, the Command Center failed to question the T/O in detail to acquire sufficient information to adequately assess the situation. Not knowing the seriousness of the situation, the Command Center concentrated its efforts on the location and removal of the southbound trains from the Clark Street tube. These trains were not in any imminent danger, were at least 800 feet from the fire location, and were lightly loaded. The Command Center did not make maximum use of all available resources (e.g. tower model boards) to accurately locate trains, which extended the time required to remove trains from the smoke filled tunnels. In addition, the CTD was unable to properly locate the 8:42 A.M. #3 NLT with respect to its location in the tunnel and with respect to the fire.

The cars of the 8:42 A.M. #3 NLT began to fill with smoke and when the passengers were moved from the front of the train, they were exposed to larger volumes of smoke as the car end doors were opened to move them towards the rear of the train.

The P.A. and HVAC systems on the cars of the trains in the vicinity of the fire location shared common trainline circuitry. The smoke surrounding the train required the HVAC system to be turned off, thereby rendering the P.A. system inoperable.

Information concerning the wrong railing of the 8:42 A.M. #3 NLT back to Borough Hall, with several injured passengers, was not promptly communicated to the NYPD, FDNY, and EMS by the C/C. As a result, the initial response to Borough Hall was delayed. As mentioned earlier, conjestion and snow may have also affected the ability of rescue agencies to respond.

The calls to obtain additional help utilizing existing direct lines of communication were not answered by EMS.

Items not having significant impact on the scenario were:

At the time of the incident, the Furman Street Fan Plant was under construction. The Old Slip Fans were operated in the exhaust mode. However, these fans pulled smoke into the tube toward the trains that were standing there. The Furman Street fans, had they been available, would not have been of assistance in this incident, due to the relative position of the trains, the fans, and the fire/smoke condition.

During this investigation several questions arose with respect to what the Authority should expect of T/Os and C/Rs who become involved in serious, life threatening situations on their trains. Among the issues raised was whether or not it would be:

- better to have two T/Os on board a train rather than a T/O and a C/R. This situation would facilitate the initiation of wrong rail moves or "adding to" reach trains in emergencies. On crowded trains the benefit would be obvious since the second T/O would have less distance to travel to move from his/her mid-train position to the rear of the train.

- better to have only one crew member, the C/R, involved in panic control situations while the T/O devoted his/her attention to overcoming train problems or coordinating the rescue effort. In the Clark Street incident the T/O tried to do both. The C/R appeared to have been less engaged in this respect. It took the T/O a long time to get to the rear of his train because he was trying to exercise panic control and attend to stricken passengers. In extreme emergencies the Board feels that the duties and responsibilities of the T/O and C/R should be clearly defined and that instructions from the Command Center to train crews should reinforce them.

  If a decision were to be made to delegate to the C/R panic control responsibilities, it would be necessary to review existing training programs to determine if the material is of sufficient strength to ensure that employees receiving the training are fully capable of handling this activity.

  Since panic control techniques were either not used or were ineffective, Rapid Transit should review the program for its efficiency and to determine if retraining programs are offered with sufficient frequency for trained personnel to maintain their proficiency.

- better to provide T/O with portable radios to enhance their ability to move about the train. The T/O mistakenly left his radio behind (in the third car) during his move to the rear of his train. The portable radio is easy to carry and use. It is less likely that it would have been left behind. A limiting feature of the portable radio is its signal strength (6 Watts). To overcome the signal strength issue an alternate distribution of radios would be to provide the C/R with the bracket-mounted 20 Watts radio and the T/O with the portable unit.

Conclusions

1. The installation of the transposition cables was improper, because concrete was removed and was not replaced, leaving an exposed area of the metal tunnel liner.

2. Primarily due to community opposition, delays in modernizing the Pierrepont - Furman substation made tube shell protection unavailable for the Clark Street Tubes.

3. Tube Shell protection, had it been installed in the Clark Street Tubes, could have reduced the severity of this incident.

4. The change in air pressure at blast areas caused snow on the tops of subway cars to become dislodged and fall to the roadbed, creating a wet condition that contributed to the development of stray currents.

5. Due to the clogged track drainage, the wet snow mixed with the steel dust, providing a leakage current path to the metal tunnel liner, causing arcing and subsequent explosions and fire/smoke conditions.

6. Existing procedures for inspection and/or maintenance of track drainage are insufficient.

7. The installation of the wiring leading from the 3rd rail lighting tap to the electrical distribution room was temporary in nature.

8. The "temporary" lighting tap was left in place for a period far exceeding a normal time frame for a temporary installation.

9. The Board could not reach a firm conclusion with respect to the role of the 3rd rail tap in the fire, because the evidence had been removed prior to the arrival of the OSS investigators.

10. Even though debris from the homeless was found in the area, it could not be determined whether it played a role in the origin of the fire.

11. The current inspection and maintenance procedures for transposition cables were found to be adequate.

12. There was a lack of coordination between the Train Operator and the C/R with respect to the movement of passengers and other emergency actions.

13. Passengers appeared to have been exposed to major amount of smoke primarily after their movement between cars was commenced.

14. Communications during emergencies are limited, because when the T/O must leave his operating position he loses the ability to communicate via radio with the RTO C/C. During emergencies or in times of mechanical difficulties with the car equipment, the C/R is more likely than the T/O to remain in close proximity to a train cab.

15. The Console Train Dispatcher did not respond to transmissions (initial reports of the fire condition) that were recorded at the C/C.

Conclusions (Cont'd)

16. Communications between the Command Center and the T/O were inadequate in that the T/O did not provide, and the Command Center did not ask for, sufficient information to develop a clear understanding of the smoke conditions being experienced by the 8:42 A.M. #3 NLT.

17. The C/T/D did not gain a clear perspective of the locations of the trains in the incident area and the locations and intensity of the smoke condition.

18. There was inadequate separation of duties and responsibilities between the Console Train Dispatcher and the Desk Superintendent, which resulted in confusion with respect to train locations, and inadequate feedback of information to emergency response agencies (TAPD EMRU/ NYPD/FDNY, etc.) that impacted their response efforts.

19. The Desk Superintendent and Console Train Dispatcher failed to use all available assets (e.g. model boards in towers) to locate trains in the vicinity of the smoke/fire, as per paragraphs "A" and "E", Command Center Directive #28-90 (Appendix F), which resulted in significant delays in locating trains, adversely affected communications, and impacted on the ability of these persons to provide ongoing information updates to outside emergency response agencies.

20. Command Center personnel fixed their attention on the trains located in the Clark Street underriver tube rather than on the train that was closest to and most heavily involved in the smoke condition.

21. Radio discipline (Code 12-1, Emergency - Clear the Air) was not adequately maintained during the Clark Street incident.

22. Command Center Directive #9-90, REPORTS OF FIRE/SMOKE - COORDINATION WITH FIRE DEPARTMENT, dated January 24, 1990, is not in conformance with Section 15.0, FAN CONTROL IN UNDERRIVER TUNNELS, System Safety Policy/Instruction 02.001.0, Procedures for Response to Rapid Transit Emergencies (with change 1) dated August 20, 1990.

23. Two of five emergency communication lines between the TA (Transit Police and RTO C/C) and EMS were out of service. Calls placed to EMS utilizing the remaining three lines were not answered.

24. Effective communications were not established between the TA and the fire department. RTO did not comply with Paragraph 4, Fire Command Post, Command Center Directive #9-90 (Appendix G), dated January 24, 1990. The instructions contained in command center directives (e.g. from operations, coordination with FDNY, etc.) are not consistent from directive to directive, and in some cases, are not in conformance with Policy/Instruction 02.001.0

25. The RTO Command Post was not established in a timely manner.

26. The FDNY was not informed of all train locations in the incident area.

Conclusions (Cont'd)

27. Since C/Rs are neither trained nor qualified to operate a train, the Train Operator of the 8:42 A.M. #3 NLT had to traverse the entire length of the crowded 10-car train (approximately 900 passengers) before he could move it, thereby delaying the removal of the train from the incident area.

28. The C/R on the 8:42 A.M NLT did not carry out the provisions of NYCTA Rule 107, C/Rs Assigned to Train Service, in that the C/R did not "have charge of (the) train(s)". T/O was not operating under "orders of the C/R" per Rule 106(c). There appears to be an inconsistency with respect to actual practice vs. requirement of the rule.

29. The passenger car equipment of the 8:42 A.M. #3 NLT had common trainline circuits for public address (PA) and Heating, Ventilation and Air Conditioning (HVAC) systems. The common trainline circuits for PA/HVAC systems prevented the crew of the train from using the PA system to communicate with passengers without activating the air conditioning system.

30. The Command Center did not follow Command Center directive #32-90, Wrong Rail Moves, with respect to the 8:42 A.M. NLT.

31. The choice of wrong railing the trains out of the tunnel was appropriate, given the alternative means of removing passengers from the smoke. In order to carry out this choice, it was necessary to delay the removal of power. Based upon the testimony given to the Board, it is not considered likely that this delay contributed to the production of substantial additional smoke (i.e. most smoke was probably produced in the first few minutes after the explosion). It is, however, the opinion of the Board, that the removal of passengers could have been accomplished faster if:

    - The Command Center had utilized Nevins Tower to help locate trains;

    - The clearing of 306 ball (the interlocking signal at Wall Street) had not been delayed by confusion of the part of the Tower Operator at Nevins Street; and

    - The 8:42 A.M. #3 NLT T/O had been given clear instructions by the Command Center that his train was going to be wrong railed back to Borough Hall; and he had been instructed to move to the other end of his train as quickly as possible.

32. Delays in the fan replacement program were due to a combination of design inadequacies, manufacturing problems and contractual issues.

33. The Furman Street fans, had they been in service, could have had an adverse effect on trains north and south of Clark Street due to the relative positions of the fan plant and the trains in the incident area.

34. The operation of the Old Slip fans in the exhaust mode drew smoke into the tube between the Clark and Wall Street Stations.

35. The best possible use of the fans under the existing circumstances would have been not to use them at all.

C. Recommendations

The Board recommends that Track and Structures Division

1. Treat blast areas as wet locations for the purpose of determining the need for or type of transposition cable Listing.

2. Install temporary wiring in conformance with established standards.

3. Review the location of power cable connections to contact rails to avoid structural alterations. In the event that such alterations are unavoidable, safeguards in addition to cable insulation shall be provided to prevent the possibility of electrical grounding.

4. Develop a power cable angle connector to minimize the need for structural alterations in tight areas adjacent to third rail transportation cables.

The Board recommends that Rapid Transit Operations Division

1. Ensure that fan operation is in accordance with Section 15.1.5 of NYCTA P/I 02.001.0.

2. Conduct tests to determine the rate at which smoke infiltrates subway cars during a fire, when doors and windows are closed, and with and without the operation of the HVAC system.

3. Issue guidance for the RTO Command Center and T/Os with respect to the movement of passengers between cars during fire/smoke situations.

4. Provide T/Os with portable radios similar to those being presently carried by C/Rs. C/Rs should be provided with the radios requiring insertion into brackets presently carried by Train Operators.

5. Provide and document training with respect for both types of radios, to C/Rs and Train Operators.

6. Investigate the feasibility of providing portable radios to both T/O's and C/Rs.

7. Provided training and refresher training to T/Os and C/Rs that emphasizes teamwork in the event of emergencies.

8. Reevaluate the CTDs involved performance and provide retraining as required.

9. Ensure that adequate console coverage is provided at all times.

10. All emergency telephone lines be checked at the change of each shift and the results of these be checks be recorded.

The Board recommends that Rapid Transit Operations (Cont'd

11. Establish procedures to require that all inoperative lines be reported to the Division of Electrical Systems for repair and that all Command Center TAPD personnel be immediately advised of the line's status and available alternatives.

12. Develop a checklist to be used by Command Center personnel as a guide in acquiring detailed information upon which to make decisions.

13. Review RTO Command Center training programs to ensure that they stress determining the problem is before decisions are made with respect to the disposition of trains in an incident area.

14. Ensure that the provisions of paragraphs "A" and "E" of Command Center Directive #28-90, OPERATION PROCEDURE FOR FAN CONTROL IN UNDER RIVER TUNNELS, dated January 24, 1990 be expanded to include all smoke and fire incidents occurring in tubes and tunnels.

15. Combine Command Center Directives #9-90 and #28-90 and ensure that the provisions of P/I 02.001.00 are adhered to.

16. Take immediate steps to instruct all personnel to adhere to the 12-1 code and that all supervisors should take immediate corrective action when violations of the code are noted.

17. Review the operating relationship between conductors and train operators to clarify the question of "who's in charge".

18. Review Command Center procedures to determine if adequate separation of duties and responsibilities between the Console Train Dispatcher and the Desk Superintendent exist, and if not, that they be formalized.

19. Expand the provisions of paragraph A, Command Center Directive #28-90 dated January 24, 1990 to include all smoke and fire incidents occurring in tubes and tunnels.

20. Develop in conjunction with System Safety, a procedure to be used to determine when a Command Post should be established. The procedure should ensure that in those cases where a command post is required, an RTO supervisor, equipped with a cellular telephone and a radio is sent to the scene and remains there until the establishment of the command post.

21. Provide the Fire Department with periodic updates of the locations of all trains in an incident area.

22. Review all Command Center directives to ensure the uniformity of information being provided, and conformance with Policy/Instruction 02.001.0.

23. Command Center adhere to Command Center Directive #32-90.